

WHAT IS CLAIMED IS:

1 1. A system for monitoring and reporting a volume
2 of data transferred between an end user and a data
3 network during a data session, said system comprising:

4 a Network Access Server (NAS) that provides the end
5 user with access to the data network; and

6 an accounting server in communication with the NAS
7 that maintains accounting records for the network, said
8 accounting server including a Prepaid Server (PPS)
9 function that maintains an account balance for the end
10 user comprising a volume of data that the end user is
11 authorized to transfer, said PPS function informing the
12 accounting server, during setup of the data session, of
13 a predetermined volume of data that the end user may
14 transfer during the session;

15 said NAS monitoring the volume of data transferred
16 between the end user and the data network during the data
17 session, and sending interim accounting messages during
18 the session to the accounting server, each interim
19 accounting message reporting a cumulative volume of data
20 transferred during the data session prior to sending the
21 interim accounting message;

22 said accounting server receiving the interim
23 accounting messages from the NAS, determining when the
24 predetermined volume of data has been transferred, and

25 notifying the PPS function when the predetermined volume
26 of data has been transferred;
27 said PPS function notifying the accounting server
28 when the account balance for the end user goes below a
29 threshold volume of data; and
30 said accounting server notifying the NAS that the
31 data session should be terminated when the accounting
32 server is notified that the account balance for the end
33 user has gone below the threshold volume of data.

1 2. The system of claim 1 wherein the PPS function
2 is implemented in a standalone Prepaid Server (PPS) in
3 communication with the accounting server.

1 3. The system of claim 2 wherein the PPS informs
2 the accounting server of a predetermined volume of data
3 that the end user may transfer during the session such
4 that when the accounting server notifies the PPS that the
5 predetermined volume of data has been transferred, there
6 is still a sufficient volume remaining in the end user's
7 account for the session to continue while the PPS
8 notifies the end user to purchase additional data volume.

1 4. The system of claim 2 wherein the PPS informs
2 the accounting server of a predetermined volume of data
3 that the end user may transfer during the session such
4 that when the accounting server notifies the PPS that the
5 predetermined volume of data has been transferred, there
6 is still a sufficient volume remaining in the end user's
7 account for the session to continue, and the PPS informs
8 the accounting server of a second predetermined volume of
9 data that the end user may transfer during the session.

1 5. The system of claim 1 wherein the accounting
2 server also informs the NAS of a triggering volume of
3 data that triggers the NAS to send an accounting stop
4 message to the accounting server.

1 6. The system of claim 1 wherein the end user is
2 a mobile station, and the NAS is a Packet Data Service
3 Node (PDSN).

1 7. During a data session, a method of monitoring
2 and reporting a volume of data transferred between an end
3 user and a data network having a Network Access Server
4 (NAS), and an accounting server in communication with the
5 NAS, said accounting server including a Prepaid Server
6 (PPS) function, said method comprising the steps of:

7 maintaining by the PPS function, an account balance
8 for the end user comprising a volume of data that the end
9 user is authorized to transfer;

10 providing the end user with access to the data
11 network through the NAS;

12 sending an access accept message from the PPS
13 function to the accounting server during setup of the
14 data session, said access accept message indicating a
15 predetermined volume of data that the end user may
16 transfer during the data session,

17 monitoring by the NAS, the volume of data
18 transferred between the end user and the data network
19 during the data session;

20 sending from the NAS to the accounting server, a
21 series of interim accounting messages during the data
22 session, each interim accounting message reporting a
23 cumulative volume of data transferred during the data
24 session prior to sending the interim accounting message;

25 notifying the PPS function by the accounting server,
26 that the predetermined volume of data has been
27 transferred;

28 notifying the accounting server by the PPS function,
29 that the account balance for the end user has gone below
30 a threshold volume of data; and

31 notifying the NAS by the accounting server, that the
32 data session should be terminated when the accounting

33 server is notified that the account balance for the end
34 user has gone below the threshold volume of data.

1 8. The method of claim 7 wherein the PPS function
2 is implemented in a standalone Prepaid Server (PPS) in
3 communication with the accounting server.

1 9. The method of claim 7 further comprising, after
2 the step of notifying the PPS function by the accounting
3 server, that the predetermined volume of data has been
4 transferred, the steps of:

5 determining by the PPS function whether there is
6 still a sufficient volume remaining in the end user's
7 account for the session to continue; and

8 offering the end user an option to purchase
9 additional data volume, upon determining that there is
10 still a sufficient volume remaining in the end user's
11 account for the session to continue.

1 10. The method of claim 7 further comprising, after
2 the step of notifying the PPS function by the accounting
3 server, when the predetermined volume of data has been
4 transferred, the steps of:

5 determining by the PPS function whether there is
6 still a sufficient volume remaining in the end user's
7 account for the session to continue; and

8 informing the accounting server by the PPS function,
9 of a subsequent predetermined volume of data that the end
10 user may transfer during the session, upon determining
11 that there is still a sufficient volume remaining in the
12 end user's account for the session to continue.

1 11. The method of claim 7 wherein the step of
2 sending an access accept message from the PPS function to
3 the accounting server also includes sending an indication
4 of a triggering volume of data, said method further
5 comprising the steps of:

6 sending the indication of the triggering volume of
7 data to the NAS;

8 determining by the NAS whether the volume of data
9 transferred equals the triggering volume of data; and

10 sending an accounting stop message from the NAS to
11 the accounting server upon determining that the volume of
12 data transferred equals the triggering volume of data.

1 12. A method of monitoring and reporting a volume
2 of data transferred between a mobile station (MS) and a
3 data network during a handoff procedure in which the MS
4 is handed off from a first Packet Data Service Node
5 (PDSN-1) to a second Packet Data Service Node (PDSN-2)
6 during a data session, said data network including an
7 accounting server, said method comprising the steps of:

8 establishing the data session through PDSN-1;
9 sending a handoff request from PDSN-2 to PDSN-1;
10 stopping by PDSN-1, a first accounting session
11 between PDSN-1 and the accounting server;
12 establishing a data tunnel between PDSN-1 and PDSN-
13 2;
14 passing data from PDSN-1 through the data tunnel to
15 the MS during the handoff procedure, PDSN-1 monitoring
16 the volume of data being passed through the tunnel;
17 requesting by PDSN-2, that the tunnel be torn down
18 when the handoff procedure is completed;
19 sending from PDSN-1 to PDSN-2, an indication of the
20 volume of data that was passed through the tunnel during
21 the handoff procedure;
22 starting by PDSN-2, a second accounting session
23 between PDSN-2 and the accounting server; and
24 sending from PDSN-2 to the accounting server, the
25 indication of the volume of data that was passed through
26 the tunnel during the handoff procedure.

1 13. The method of claim 12 wherein the step of
2 establishing a data tunnel between PDSN-1 and PDSN-2
3 includes establishing a Point-to-Point Protocol (PPP)
4 connection between PDSN-1 and PDSN-2.

1 14. The method of claim 13 wherein the network also
2 includes a Prepaid Server (PPS) in communication with the
3 accounting server that maintains an account balance for
4 the MS that indicates a maximum volume of data that the
5 MS may transfer during the data session, and the method
6 further comprises the steps of:

7 sending an access request message from the
8 accounting server to the PPS, said access request message
9 including the indication of the volume of data that was
10 passed through the tunnel during the handoff procedure;
11 and

12 determining by the PPS, a new maximum volume of data
13 that the MS may transfer during the data session by
14 subtracting the volume of data that was passed through
15 the tunnel from the maximum volume of data that the MS
16 may transfer.

1 15. The method of claim 14 further comprising the
2 steps of:

3 sending an access accept message from the PPS to the
4 accounting server, said access accept message indicating
5 the new maximum volume of data that the MS may transfer
6 during the data session;

7 monitoring by PDSN-2, the volume of data transferred
8 between the end user and the data network during the data
9 session;

10 sending from PDSN-2 to the accounting server, a
11 series of interim accounting messages during the data
12 session, each interim accounting message reporting a
13 cumulative volume of data transferred during the data
14 session prior to sending the interim accounting message;
15 notifying the PPS by the accounting server, that the
16 predetermined volume of data has been transferred;
17 notifying the accounting server by the PPS, that the
18 account balance for the end user has gone below a
19 threshold volume of data; and
20 notifying PDSN-2 by the accounting server, that the
21 data session should be terminated when the accounting
22 server is notified that the account balance for the end
23 user has gone below the threshold volume of data.

1 16. A system for monitoring and reporting a volume
2 of data transferred between a mobile station (MS) and a
3 data network during a handoff procedure in which the MS
4 is handed off from a first Packet Data Service Node
5 (PDSN-1) in which the session is established, to a second
6 Packet Data Service Node (PDSN-2) which sends a handoff
7 request to PDSN-1 during a data session, said system
8 comprising:
9 an accounting server in the data network that
10 monitors a series of accounting sessions during the data
11 session;

12 an accounting stop mechanism within PDSN-1 that
13 stops a first accounting session between PDSN-1 and the
14 accounting server when PDSN-1 receives the handoff
15 request from PDSN-2;

16 a tunneling setup mechanism that establishes a data
17 tunnel between PDSN-1 and PDSN-2, and passes data from
18 PDSN-1 through the data tunnel to the MS during the
19 handoff procedure;

20 a tunnel tear-down mechanism that tears down the
21 tunnel when requested by PDSN-2, as the handoff procedure
22 is completed;

23 a data monitoring mechanism within PDSN-1 that
24 monitors the volume of data passed through the tunnel,
25 and sends from PDSN-1 to PDSN-2, an indication of the
26 volume of data that was passed through the tunnel during
27 the handoff procedure;

28 an accounting start mechanism in PDSN-2 that starts
29 a second accounting session between PDSN-2 and the
30 accounting server when the indication of the volume of
31 data that was passed through the tunnel is received from
32 PDSN-1; and

33 an accounting communication mechanism in PDSN-2 that
34 sends from PDSN-2 to the accounting server, the
35 indication of the volume of data that was passed through
36 the tunnel during the handoff procedure.